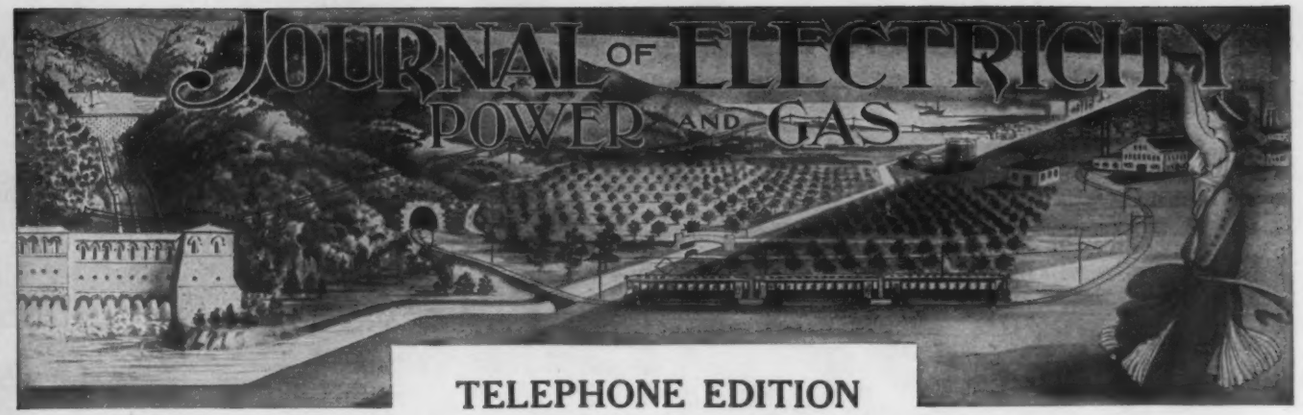

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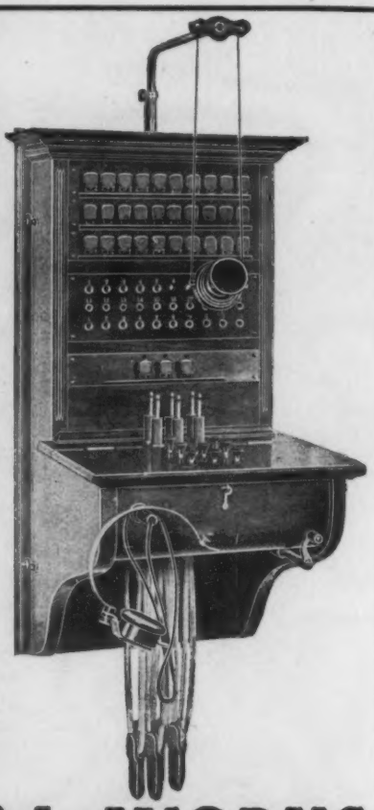

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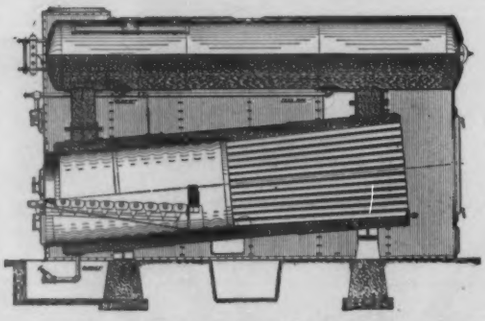

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VOLUME XXI. SAN FRANCISCO, CAL., JULY 11, 1908 No. 2

The New Pupinized Loaded Telephone Cables in Germany

About a dozen loaded telephone cables have been laid in Germany during the past two or three years. The last cable has a length of 15½ miles and connects Berlin and Wannsee. This cable has copper .8 millimeters in diameter with 250 double wires and having a distance of .9 mile between the successive inductance coil boxes. There is now in course of installation a cable loaded with Pupin inductance coils, between Berlin and Kopenick, and another between Duisburg, Mulheim and Oberhausen. The former cable is 11 miles long and has 56 double wires .8 millimeters in diameter, the distance between the successive inductance coil boxes being one mile. The Duisburg-Oberhausen Pupin cable is 17 miles in length and is provided with 56 double wires, a part of which are 1.5 millimeters in diameter, the rest of the copper being 2 millimeters in diameter with distance of .9 mile between the successive inductance coil boxes. These telephone cable lines loaded with Pupin inductance coils, about a dozen cables in all, have a total length of about 270 miles.

A little over a year ago a submarine loaded telephone cable was laid with considerable difficulty between Friedrichshaven and Romershorn, this Bodensee cable being 7½ miles long. The accompanying illustration shows the details of construction and the laying of this cable in Lake Constance.

Between Fehmarn and Laaland there is a telephone cable having a total length of 238 kilometers, this being a lead-covered cable, the iron wire measuring .3 millimeters in diameter. A similar cable was laid between Cuxhaven and Heligoland, having a total range of 385 kilometers.

LAYING THE PUPIN CABLE IN LAKE CONSTANCE.

We now come to the Pupin system of raising the self-induction without any capacity being added and at the same time the damping is considerably decreased. The resistance is, of course, increased by an amount equal to that of the coils, but the "pupinized cable" is very much cheaper than the cable with distributed self-induction. For underground cables there is no difficulty about connecting the coils, but for submarine work the utilizing of these coils is a more

difficult matter, as they must be placed in the circuit before it is laid, but these difficulties have been met and overcome by Siemens & Halske of Berlin, not only on a cable laid between Friederichshaven and Romanshorn for the states of Bataria, Wurtenberg and Switzerland for the government telephone system, but also on other submarine cables laid before and since, including those now in course of erection between Berlin and Kopenick and between Duisburg and Oberhausen.

As the cable could not be brought to Lake Constance for laying by ship without being first transported by rail, the construction and laying of this Pupin loaded telephone cable across Lake Constance was no small matter, and the cable had to be laid at a depth of about 138 fathoms, the contour being different on the two sides and gradually falling to a deep channel, traversing the whole length of the lake.

It was necessary that the cable be capable of standing the water pressure of 25 atmospheres at this depth, and a factor of safety of six was taken, so that the tests were carried out on the cable with a pressure of 150 atmospheres for short periods, the cable tested having seven circuits and being lead covered. As the cores should not be allowed to sustain the pressure and the capacity had to be kept down, the lead sheet had to be strong enough to prevent the conductors being pressed together. It may be stated that it was specified that the whole of the submarine cable, about every one thousand feet, should be provided with arrangements for preventing water, which might be forced in through a fault, from getting over the dividing piece. At the same time that the Pupin coils were connected in circuit, this was solved. The coils have larger diameter than the cable cores and a thicker lead sheath was necessary at the coils, a pressure of 25 atmospheres being, of course, withstood at these places required a testing pressure of 150 atmospheres for a longer time.

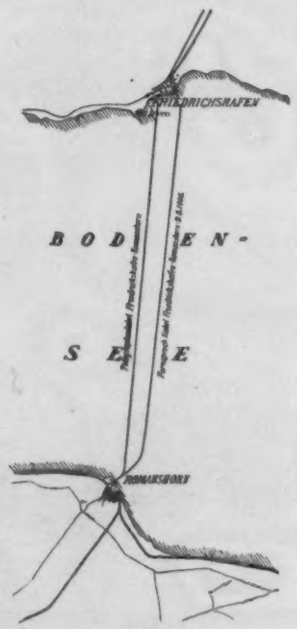
It may be stated that the coils are circular in form, connected in circuit with one conductor, while through their center another conductor passes with which they are not connected, dividing pieces separating them, while the connection between the cylindrical cable and the symmetrical coil is made by a conical piece. This acts as a division and in case of a fault prevents the advance of water, two of these conical pieces being provided to each coil with a water tight joint on both sides.

It is stated that every 3000 feet or more the coils are connected into the double wire circuit, and in the armored cable every 1000 feet, the core being stretched at the place by a pull of about 4000 pounds, while the operation of connecting the Pupin coils in the armored cable is carried out by hand.

The accompanying illustration shows the submarine cable laying equipment used for deep sea work, as employed in laying the 9 1/3 miles of Pupin cable in Lake Constance, and as the weight of the cable was considerable when paying out at deepest places, a pull of about 4000 pounds had to be provided for, and this pull could not be regulated by an ordinary friction brake, and considerable space was required to erect a suitable machine for the purpose. After one unsuccessful attempt with a drum five feet eight inches in diameter, a special laying machine was designed by Herr Weiss, a specialist at this work. This drum having a diameter of eight feet was then used as constructed in Berlin by Fr. Gebauer.

It may be stated that as the coils were distributed over the cables there were irregularities in the laying, owing to the unevenness in the running out, and in order to avoid the cable springing off the roller, special guides were provided in front of the wheel, while the dynamometer was made larger, designed to serve the purpose of checking the amount of pull, and at the bow of the ship the run-over roller was also made larger.

The cable ship was towed by the "Konig Wilhelm" as near to the shore as possible, and the cable end was taken out and drawn into the measuring room on the shore. The cable was buried in a trench which had to be dredged out, and auxiliary boats and floats had to be provided as it was not possible to approach very close to the shore with the cable ship. The average laying speed was about five knots per hour, so that this submarine cable was laid in about two hours and was kept under inspection a day and night after laying, watching out for faults. The buoys were taken up as the cable ship returned to Friedrichshafen. The next day, after the laying, the splice was made between the shore end at Romanshorn and the submarine cable, and after the splice was made on the ship a coil was connected in circuit and the cable sunk in the lake. Afterwards the shore end was jointed to the land cable and the cable-laying proper thus completed.



ROUTE OF CABLE.

This Pupin cable has a total range of 347 kilometers and is nearly equal to the cable between Cuxhaven to Heligoland, having the lowest self-induction of those iron wire-covered lead cables above mentioned. It will be noted, however, that the cross section proper is 12.6 square millimeters for the Cuxhaven-Heligoland lead-covered iron wire-covered cable, while the Pupin cable laid in Lake Constance has only 1/7 of the cross section of copper or 1.77 square meters. The Pupin cable across Lake Constance has a resistance of 3.35 ohms and a damping factor of .0072, while the self-conducting is .21 henrys and the capacity .039 mfd. Between Berlin and Potsdam a Pupin cable was laid, having a length of 40 kilometers with 100 double wires .9 millimeters in diameter with a distance of 1.4 kilometers between the successive inductance coil boxes, and another cable 18 kilometers long was laid between Berlin and Seandau, having 112 double wires with copper .8 millimeters in diameter and a distance between successive inductance coil boxes of 1.75 kilometers. It is stated that all of the above cables have been in uninterrupted service since their installation and have given excellent satisfaction. There is every reason to believe that the "pupinized" cable will be utilized for submarine telephone service for even greater distances in the future, the cables loaded with Pupin inductance coils already in service having demonstrated the merits of this system.

It may be stated that up to the present time two types of cables have been used in telephone work for submarine service in crossing short arms of the sea. One of these

types consists of a gutta-percha covered cable, in which the influence of self-induction on the speaking power is not noticeable and efforts have been made with this kind of cable to keep down the resistance and the capacity. It is stated that by increasing the size of the copper conductor the resistance of this cable is reduced, although at great expense, and the capacity is lowered also by the increased expense of making the thickness of the gutta-percha covering greater. A cable of this kind was laid between Belgium and England, this being a four-core cable. The telephone cable between London and Paris has had the charging capacity greatly reduced by having the four conductors in the cable provided with a common gutta-percha covering.

The other type of cable utilizes self-induction for decreasing the damping of speech, a covering of iron wire being given to the cable, thereby distributing the self-induction equally over the conductors. There were two cables of this type 300 kilometers in length laid between Soelvig and Refsnaes, one of which was lead covered and the other had a simple gutta-percha insulation. It is stated that the largest number of cores that can be laid up in these cables is four, making two complete speaking circuits, one circuit being made up of two opposite conductors, and it is held that as each conductor lies symmetrically with regard to both conductors of the other circuit, and between the two there is no cross-talking.

These cables were all laid in the North Sea and Baltic Sea in shallow water, with a maximum depth of not more than twenty-seven fathoms. It is held that by the use of an iron wire covering, the self-induction is increased only up to certain limits and the capacity by this method is also increased if the diameter of the cores or insulating covering is not also enlarged at the same time, and this means a cable of very great expense. There are three iron wires, each .2 millimeters in diameter, on the gutta-percha cable between Soelvig and Refsnaes, the capacity being .12 m. f. d., and the self-induction .0087 henrys, with a resistance of 4.55 ohms. The total range of the cable is 300 kilometers, the diameter being 3.3 millimeters and the cross section 8.6 square millimeters, with a damping factor of .0084.

A COMPLICATED COMPLAINT.

The telephone manager is fortunate when a letter of complaint is capable of being turned into a source of amusement. This sometimes happens, as is shown by the following letter, received by the telephone company at San Francisco:

Gentlemen: I now take the steps to inform you that I have no prosperity at present time with the restaurant which I keep, so I must take cheaper rate phone. My nearly by neighbor has got a phone also which is a nickel kind I like to get the phone as him but another one. I make two requesteds of the recent dates for to have sent up a man to do as above required but nobody show up to do it for me and further, I wait all last weeks expect for him to come but not.

Please kind sirs make a hurry as soon as you possible in order to help out my business troubles which I worry every day since hard times can come by. As a matters of importance I request to you a new book for my place one with outside city names which I understand is in the uses of subscribers for telephones.

Here I also complain against operator on my fone is very bad, she say hello what number you want and I say the number and she say questions after questions again for the same number and call skidoo skidoo every time I make a requests for numbers. I wish you for to please kindly make a stops to prevent some more as this.

Please sent up a man as before requests and do much to get service as better what is possible and I am obliged, Very truly, Y. Sugihara.

TELEPHONE LINE CONSTRUCTION.*

By L. E. Hurtz.

Before setting, poles should be shaved and carefully framed. That is, the top should be "roofed" by sawing off pieces at an angle of forty-five degrees to the side, leaving the top of the pole sharpened to an angle of ninety degrees. A "roofed" pole sheds the water more effectively than if left flat, thus making the top less liable to decay. Gains or flat spots about one-half inch deep should be cut in the poles that are to carry cross-arms, at the points where the arms are to be fastened, thus forming a good bearing for them, and one hole large enough to take a five-eighths inch through bolt should be bored through the poles at each gain that is to be used at once. The roofs and gains should be painted with a good paint that will close all the pores and thus stop the entrance of water and prevent decay. The butt should then be treated with some preservative. Details for such treatment can be found in various publications of the Forestry Department. Since the labor of replacing poles is so high, it is very essential that the poles last as long as possible without having to be reset or replaced.

The poles should be set substantially, and to make a good job, the soil and weather conditions should be taken into account. In ordinary soil not subject to floods, a good rule to follow is to set a twenty-five-foot pole five feet deep, and to dig the hole six inches deeper for each additional five feet of length. Thus a forty-foot pole would be set six and one-half feet deep, which is probably a trifle deeper than they are usually set. If the ground is moist or marshy, or if otherwise unsatisfactory conditions are met, special settings must be provided. For instance, a barrel of sand is sometimes used at the bottom of the pole; or rocks, ties or timber are put in the bottom of the hole or a foundation of several inches of concrete is used or the pole is set entirely in concrete. Sometimes in street-railway work, the butt is set in concrete to the depth of about six inches, then dirt filled in and tamped to within six inches or a foot from the top, then this part filled in with concrete, so that the strain or the span wire will be taken up in the enlarged surface at the top and bottom of the pole, at which points the strain is the heaviest.

Great care should be exercised in the location of poles. In the building of a new plant, as well as in construction work in an old one, the law regarding the location of poles should be referred to, in order that it will not be necessary at some later time to move the poles, which is an expensive operation. Poles located in streets and alleys should usually be set on lot lines in order that the residents of the neighborhood cannot complain that they interfere with driveways, barns, etc. In setting poles along streets and alleys which are not paved, great care should be taken in their location, so that if paving is put down at a later time it will not be necessary to move them. Here it might be stated that where two cables cross at right angles at intersections of streets, or of a street and alley, it is not good practice to locate a pole at the point where the intersection of the lines will be, for the reason that it runs a double

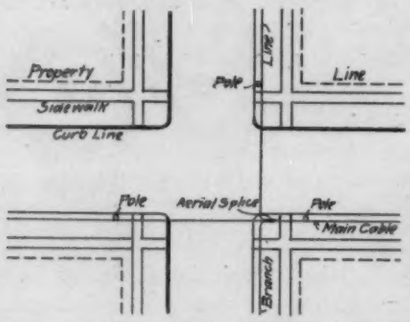
*Extracts from paper in "The Nebraska Blue Print," published by the Engineering Society of the University of Nebraska.

chance of having to be moved if either street or alley is paved.

A very effectual way to overcome this trouble is by making what is known as an aerial turn as illustrated in the accompanying figure, setting the four nearest poles back at such a distance from the intersection that there is little probability of their having to be moved. In case they should have to be moved at a later date, it could be accomplished much easier than if the messenger and cable had been fastened to a pole at the corner.

Fir cross-arms have been used most generally and have given very satisfactory service when not painted. It seems that filling the pores with paint causes the arms to rot inside, with the consequence that some day they break off while they are apparently in good order. This is a source of accidents to employees on account of the arms not showing their real condition.

Locust pins have given most general satisfaction for many years. Many other woods have been used, among them being oak, which is not satisfactory, and osage orange, which is very good. Iron pins are used by the telegraph companies, but have not come in general use on telephone lines.



SKETCH SHOWING METHOD OF MAKING AERIAL TURN.

The hardware used should be heavily galvanized to secure long and efficient service. This is especially true in damp climates. While galvanized hardware lasts much longer than plain, it is open to the objection that all the threaded parts must be cut first and galvanized afterwards. This necessitates the cutting of loose threads and making up the difference with a coat of spelter, which may come off later and leave a poor thread.

Anchors are very important. They should be used at every place where a branch leaves the main line or where there is an offset in the line and at every dead end. The material used for the "slugs" or dead men may be any one of several kinds. Those used most are wood, either logs, parts of poles, ties or other timber; these may be used plain or soaked in some preservative; treatment similar to that given pole butts. Since any of these wooden slugs will last but a comparatively short time under ordinary conditions, several patent metallic anchors have been put on the market in the last few years in an effort to get a cheaper and more durable anchor. Some of them are really meritorious and others have proven dismal failures, while almost any of them are of some service under the right conditions.

Considerable judgment must be displayed in choosing an anchor. Be sure that the size used is the smallest that will hold the load safely; but do not carry economy too far and get an anchor too small for the service required. By figuring the cost of material and labor of setting, it is an easy matter to choose the anchor giving the best result.

A new departure in anchors is the use of a reinforced concrete slab for the dead-man, the idea being that the concrete slab is practically indestructible, so that if the proper size is chosen it should last for a very long time without having to be replaced.

A STUDY OF MULTI-OFFICE AUTOMATIC SWITCHBOARD TELEPHONE SYSTEMS.*

By W. Lee Campbell.

This paper treats of three principal topics:

1. The enormous economic waste which the wire, cable and conduit equipment of a telephone system involves.

2. A recapitulation and discussion of reasons which make this waste necessary or expedient in manually operated systems.

3. How this waste can and should be greatly reduced in systems employing automatic switchboards.

The first cost of a telephone plant using switchboards of either type may be divided into three principal items:

1. Cost of the apparatus (both central office and subscriber's station).

2. Cost of the central office buildings and furnishings.

3. Cost of the wire, cable and conduit plant.

In the third item of the first cost—the wire, cable and conduit plant—we find the largest factor of the three. Under almost any circumstances this part of the system will cost more than the two other parts combined; not infrequently it represents two-thirds of the entire first cost of the system. In the average telephone system containing one central office only, nine-tenths of the cable and wire plant is idle—not in use for transmitting conversations, even at the peak of the load; and, too, that on the average during twenty-four hours' service, 98% of the wires are not in use.

Taking up the study of the factors that govern the first cost of a common-battery system of either type, we find, first, that the cost of the ordinary direct-line, flat-rate telephone at the subscriber's station is about the same ($7.25 each) in all sizes and conditions of modern common-battery manual plants, and $12.50 each in automatic plants. The cost of a private branch switchboard at a subscriber's premises is not materially affected by the size, location or type of the central office to which it is connected. This, therefore, will not be taken into consideration.

The cost of the central office equipment when all installed in one office depends upon the number of lines entering the office and the number of connections demanded during the busy hour of each day. No storage feature is possible in a telephone plant. The switchboard must be designed to take care of the peak of the load, no matter how exaggerated that peak may be.

For the benefit of those not familiar with automatic switchboards, the writer will state that each line terminates in what is generally called a line switch. These line switches are arranged and multiplied together in groups of 100 each. Connections between these groups are made by means of trunking switches called first selectors, second selectors, third selectors, and connectors. In a system having an ultimate capacity of 1000 lines, first selectors and connectors are the only trunking switches used. When the ultimate capacity is increased to 10,000 lines, second selectors are required also; and when the ultimate capacity is increased to 100,000 lines, third selectors are added. In a 100,000-line system, then, there is one first selector, one second selector, one third selector, and one connector for each trunk equipped.

A system with an ultimate capacity of 18,000 lines is made by installing a section of switchboard equipped for 8000 lines and arranged for an ultimate capacity of 10,000 and another section of switchboard equipped for the remaining 10,000 lines and using third-selector switches as if installed for an ultimate capacity of 100,000 lines. Such a combination does not involve any complications and makes

*Abstract of a paper presented at the twenty-fifth annual convention of the American Institute of Electrical Engineers, Atlantic City, N. J., June 29—July 2, 1908.

the cost less than if the entire equipment were arranged for an ultimate capacity of 100,000 lines.

The cost per line of manual equipment increases rapidly with the size of the office. This increase is principally due to the greater and greater number of multiple jacks which must be placed within each operator's reach, whereas, since the automatic is a trunking system, the cost per line is affected only by the slow growth in the number of trunks necessary to handle the busy-hour calls, and, at intervals, an increase in the ultimate capacity of the switchboard. The price of this equipment, therefore, rises more gradually and in the larger offices falls below that of the manual type.

The cost of building space for automatic equipment is considerably less than that for manual equipment, and that for offices of over 5,000 lines the automatic occupies about half the space required for the manual. No effort has been made to secure comparative figures on the cost of furnishings, but they are unquestionably more expensive in manual offices, since here recreation and rest rooms, restaurant, kitchen, etc., are commonly furnished and equipped for the use of the operators. In automatic offices the number of employees is comparatively small and the men are in the majority; consequently, it is not customary to make any elaborate provision for their comfort when off duty.

There is little probability, in the near future, of a manual switchboard being rendered obsolete by a more improved manual board or of an automatic switchboard being put out of the arena by an automatic switchboard giving better service. Take the life of a manual switchboard at the full amount that a consideration of wear and tear only will permit, and, in order to be perfectly conservative, place the life of an automatic board at but two years longer, although there is no reason to suppose that it would not still be good for a number of years of service at the end of that time, then the amount which must be set aside annually at 6% compound interest to equal 100% in twelve years is 6% of first cost. Therefore, this percentage is used in calculating depreciation on automatic central office equipment, while for manual equipment the depreciation charge is taken at 7.5%, which is the amount which must be set aside annually at 6% compound interest to equal first cost in ten years.

Looking into the matter of maintenance material or renewals for automatic central office equipment, the writer has found from an investigation of a number of automatic plants that the renewals for the switchboard proper amount on the average to 0.2% per annum on the first cost of the central office equipment. The power plant, main distributing frame, and other parts of the central office equipment, increase the renewals item, however, and in order to cover everything it has been taken at 0.5% for automatic offices.

The cost of power per originating call handled is about twice as much for automatic switchboards as for most of the manual switchboards used by the "independent companies." The amount of current consumed is almost the same, 0.006 of an ampere-hour. Automatic plants generally use a battery of forty-six volts, about twice the voltage of the usual manual battery, although in large plants where the lines are long, forty-volt batteries are sometimes employed in manual practice. The manual switchboards generally used by the Bell companies require considerably more current than those used by the independent companies. The amounts used by the independent boards have been taken in working out the curves in this paper. Taking the cost of power, transformed and delivered at the switchboards, at fifteen cents per kilowatt-hour gives a cost of $0.0216 per thousand local calls for manual offices and of $0.0432 per thousand local calls for automatic offices. The additional cost per thousand incoming trunk calls received at a manual office would be $0.0144. For automatic offices the additional cost for incoming trunk calls would be $0.004 per thousand, assuming that the number of calls trunked out from an office equals the number incoming.

The cost of lighting automatic central office equipment has been taken at $4.00 per thousand lines per month; and for manual offices the cost of lighting the operators' positions, the switchboard rooms, operators' retiring rooms, terminal room, desks, etc., has been taken at $2.00 per switchboard position per month. The annual charges on the central office buildings have been taken at the same rates for the two systems; that is, insurance on fireproof central office buildings has been figured at 0.5% per annum, interest at 6%, taxes at 1%, and depreciation and repairs at 2% per annum.

In calculating depreciation, the life of the telephones for both systems has been taken to be ten years. It might appear unreasonable at first thought to believe that the more complicated automatic telephone has as long a life as the simpler manual instrument, but experience shows that the parts of a telephone which depreciate most rapidly are those which are handled by the user, knocked and rubbed against by passers-by and mischievous persons; also that the parts which must be kept highly finished, because they are exposed to view, are most quickly affected not only by human contact but by sunshine, dampness, etc. Consequently, since very little more of an automatic telephone than of a manual telephone is exposed, and since the calling device, which represents about 40% of the value of the instrument, is locked inside the case, where it is subject only to wear and tear of legitimate service, which it will successfully withstand for at least fifteen years, the writer has concluded that automatic telephones could reasonably be considered to be longer lived on the average than manual telephones. He has, however, as already stated, placed the two on the same basis.

The cost of material for repairs and renewals on automatic telephones is a little greater than for the manual. It was found by a thorough investigation that the cost of new parts peculiar to the automatic telephones amounts to 0.14% per annum.

Increasing the number of offices in an automatic system does not appreciably affect the service. All calls are trunked anyhow, whether one office is used or many. Therefore, splitting up such a system does not add to the amount of trunking or in any way affect the speed and uniformity of service. The subscriber is not required to change his method of calling or to make more turns of his dial. No more automatic switches are necessary and a connection does not include any more switches in a divided system than in a single office plant. When the writer states that the service of a multi-office automatic system is on a par with that of a single office automatic system, he believes that he gives it the highest endorsement possible in the present state of the telephone art; for the companies operating automatic switchboards have demonstrated beyond question that they can give satisfactory service and furnish any special attention to which patrons of the girl-operated systems have been accustomed. Indeed, telephone users, who have had experience with both, almost universally prefer the automatic service to the manual.

Not only has the writer not discovered any reasons which weigh materially against division of automatic systems, but he finds that the saving in the investment in cable, wire, and conduit would be even greater than in a manual system. First, because division may, as clearly shown, be carried much further without seriously affecting central office expenses, and secondly, because the number of trunk lines required for handling traffic between automatic offices is less than between similar manual offices. In other words, an automatic trunk will carry, on the average, more busy-hour calls than a manual trunk.

One reason for the increased efficiency of automatic

trunks is found in the shorter length of time per connection. In manual practice it has been found that each trunk is occupied on the average at least two minutes per connection, whereas automatic experience proves that during the busy-hour a trunk is not occupied over eighty-three seconds per average connection. A subscriber to automatic service answers his telephone quicker and generally does not hold the line so long for conversation as does a manual subscriber; also, the disconnection is made much quicker in the automatic system. This feature of the quicker disconnection is especially helpful during the busy hours when manual operators are most likely to be rushed and consequently slow about pulling down connections. The interval of time that elapses between release of a trunk by one automatic selector and seizure of it by another need be, and often is, but a fraction of a second. This, too, helps to increase the carrying capacity of the trunks.

In endeavoring to form some conception of the methods used for introducing trunking of calls on a large scale between automatic offices, it is well to understand the difference between two general types of office that are being used for this purpose. One is known as a "sub-station" or "district" office and the other as a "branch" office. The difference lies in that a sub-station contains line switches and connector switches but no apparatus for making local connections; that is, every originating call is trunked to a distant larger office containing the selector switches, whereas a branch office contains switches of all classes and completes within itself all local connections demanded. It will readily be seen, therefore, that a sub-station requires more outgoing and incoming trunks than a branch office.

The sub-station is also especially adapted to a small isolated district where the expense of a constant local attendant would not be warranted, and, where it is, therefore, considered advisable to install the simplest apparatus obtainable, with arrangements for supervision from the main office to which the sub-station trunks are connected. Under almost any conceivable condition a sub-station will require more trunks than a branch office for several reasons. First, all calls must be trunked; second, there is one group of outgoing and one group of incoming trunks for each 100 lines connected to the sub-station; third, in order to provide thorough supervision from the main office, each outgoing trunk contains three wires instead of two.

It is, therefore, seen that in considering the advisability of installing a sub-station instead of a branch office, the increased expenditure for trunk installation and maintenance should be weighed against the saving in cost of supervision and attendance.

When the proposed office is to be a small one, and the trunks to it are to be secured by converting the line cable at present entering the new office district into a trunk cable, there is often no immediate advantage in economizing in the number of trunks. To such conditions a sub-station is well suited even if the trunks are long and consequently expensive. It would appear, however, that in the present state of the art such an auxiliary to a "main" office would rarely be warranted if it contained over 500 lines.

One of the peculiarities of the telephone business, especially when there is competition, is that an operating company is compelled to take on the new business offered. It must keep up with its rival or drop out of the race. A user of electric light does not care how many other customers are connected to the same plant that he is, but a telephone user is, of course, very much attracted by the larger of two lists of subscribers. Unfortunately a one-office plant is somewhat like a water or gas plant, in that new customers cannot be constantly added by simply connecting their service pipes to the mains originally installed. Some day a point is reached when the mains are supplying all the flow of which they are capable and it is necessary to go back to headquarters, dig up the streets anew, and put in more mains or larger ones. So in a one-office telephone system, if the growth is more rapid than anticipated, as it often is, or if the growth of the city takes place in an unexpected direction, as it frequently does, it becomes necessary to remodel the cable and wire plant to suit the new distribution of business.

A one-office telephone plant sometimes must be almost entirely rebuilt within a few years of its installation in order to adapt it to a shifting of population, or to make it adequate for the customers unexpectedly demanding service.

With a multi-office automatic system this need not be done. If an unexpected demand for telephones develops in a certain section of the city, it is not necessary to put in more conduits and cables or to replace present cables with larger ones to take care of the demand, but the situation is readily and practically met by putting in a sub-station or a branch office in the congested district. The present line cables running to the district may be used as trunk cables to the new office. Thus the traffic-carrying capacity of the cable and conduit plant reaching any district may be greatly multiplied without any additional expenditure for cable or duct. Consequently, one of the most attractive features of an automatic multi-office system is that it affords a stable value to the investment in wire, cable and conduit.

A CONTEST IN COURTESY.

Public interest in a plan inaugurated some time ago by the Chicago Telephone Company, whereby monthly efficiency contests are held among the operators, has reached the point where it threatens to distract from the present exciting baseball struggle.

The telephone company gives two prizes every month to the exchanges making the best record for good operating, as shown by the service-inspection tests, which are constantly being made by the company's inspectors. The prizes are in the form of pictures or other ornaments for the exchange, which are chosen by the girls, and one is awarded to the best day force and the other to the best night force.

The Lincoln office was recently opened. At the beginning of the month the girls on the day force held a conference and decided that it was up to them to show the other exchanges what they could do by taking the day prize. Word was passed around and the competition started in deadly earnest. Even the subscribers noticed the unusual courtesy and dispatch with which their messages were handled and commented on it.

The spirit of the girls was contagious. Other exchanges heard of their efforts and determined not to be outdone. When the results were figured up it was found that the honors were very evenly divided between half a dozen exchanges. Douglas headed the list for the day prize, however, with the Lincoln girls just one point behind. The prize for the night force was won by Edgewater exchange and will be added to the many trophies that have been won by that office.

The prize system was inaugurated by the telephone company in 1904 and has been in force ever since. Daily tests are made, unknown to the operators by a corps of "service inspectors," who note the way the messages are handled and mark the operators on their work. Some of the inspectors go about the city originating calls, while others sit at a special board in the main office and cut in on the wires. Operators are marked down for actual errors, but many of the faults for which points are taken off are so technical as to have no direct effect on the subscriber, although they are regarded as of importance in the operation of a large exchange. The marking is on a scale of 100. Discourtesy has the first place on the list, counting ten points against the operator. Among the other faults listed are "wrong numbers," "cut-offs," "tardy in returning nickel," and "failure to repeat order."

THE LAW OF THE TELEPHONE.

By Emerson W. Read.*

In many Courts the telephone and telegraph have been regarded in much the same light as respects the public and private rights and duties growing out of the two agencies. So, too, with litigation that has arisen over questions of invention. So far has this similarity in the two agencies influenced the minds of Courts that in England, where a Statute existed reposing exclusive control over telegraph messages in the Postmaster-General, the term "telegram" was interpreted as a term including a conversation by telephone (Attorney-General v. Edison Telephone Co., L. R. 6 Q. B. D. 244). In our own country State Courts are inclined to regard this similarity and render their judgments on questions respecting the telephone according to precedents already laid down on the telegraph, and vice versa. In Iowa, a question of jurisdiction of a municipal Court having arisen, the Court on Appeal classed telephone companies with telegraph companies (Franklin v. N. W. Telephone Co., 69 Iowa 97). For purposes of eminent domain Courts have held that privileges accorded to telephone companies must be accorded to telegraph companies, both having similar public natures and corresponding methods of conveying information; equal and parallel rights are accorded each in the use of public streets; and restrictions applied to the one by Statutes are almost co-extensive with those applied to the other.

It will be noticed that the California Legislature carefully respected this similarity in its enactments in the Civil Code on "Carriage of Messages." "A carrier of messages for reward, other than by telegraph or telephone, must deliver them at the place, etc. . . Such carrier, by telegraph or telephone, must deliver them, etc." (Cal. C. C., Sec. 2161). From this it is apparent that our Legislature aimed to impose no burden in delivery upon the telephone that was not incident to the telegraph. And in Sec. 2162 the Code exacts the same care and diligence on the part of both in the transmission and delivery of messages.

State Statutes require, generally, that articles of incorporation fully set out the purposes for which the incorporators associate and that an act performed outside of powers obtained by the charter is *ultra vires*. However, in Wisc. Telephone Co. v. City of Oshkosh, 62 Wisc. 36, the Court held that a company could incorporate as a telephone company under a Statute which provided for the formation of companies "to build and operate telegraph lines or conduct the business of telegraphing, and to conduct and maintain such lines with all necessary appurtenances." The Court said, "Of course, there is a distinction between the two classes of business; but in almost every respect they are very similar, if not identical. Each of them must erect its poles or posts, and upon the tops of them attach its lines of wire from point to point. Each must almost necessarily enter upon, along, or across public roads, highways, streams, bodies of water, and upon the lands of individuals, for the purposes mentioned. In these respects, they are seemingly identical."

Incorporation of telephone companies under Statutes speaking only of "telegraphs," has happened on numerous occasions, even when no mention whatever is made of "telephone." This is unquestionable, however, as Courts have reasoned that, in the earlier days of the telegraph the telephone was yet unknown; that the Statutes provided for future possible inventions in that particular field; and that the telephone was such an outgrowth. "No one supposes that the Legislature intended to refer specifically to telephones many years before they were invented; but it is highly probable that they would, and it seems to us clear that they actually did, use language embracing further discoveries as to the use of electricity for the purpose of conveying intelligence."

Both companies are generally considered common carriers. As a public service corporation either may invoke the privilege of condemnation by eminent domain that it may erect its plants and transmission appliances (Pierce v. Drew, 136 Mass. 75). California has enacted otherwise, however. Sec. 2168, Cal. C. C., says: "Everyone who offers to the public to carry persons, property or messages, excepting only telegraphic messages, is a common carrier of whatever he thus offers to carry."

However, whatever the Legislatures in the various States wish to enact respecting these companies, a long and judicious series of decisions in many State Courts has established fully that their natures are those of common carriers. They are obliged to extend the same facilities to such persons as comply with the company's legal regulations. They can impose reasonable regulations upon the public and a compensation may be exacted for services rendered. They must not discriminate in favor of some and deny to others. Persistent litigation, alone, has established the public's right to equal and undiscriminating service on the part of these companies. "But from the very first, the Courts have interposed by mandamus in favor of persons to whom the use of this service has been denied." (State v. Bell Tel. Co., 10 Cent. L. J. 438); (Bell Tel. Co. v. Commonwealth, 35 Alb. L. J., p. 4.)

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Recent Decisions.

(1)

A city engaged in the enterprise of manufacturing and selling electric light to its inhabitants is not engaged in a public, governmental duty, and consequently is held to the same responsibility for injuries received on account of the negligent conduct of its officers as would a private individual running an opposition plant in the same municipality. As the owner and operator of an electric lighting system, it is the duty of a municipality to exercise the diligence and care commensurate with the dangers of the force it is handling, in order to prevent injury to those engaged in their various pursuits and callings. It is negligence in a municipality maintaining its electric lighting plant and having notice of the condition of a wire to allow a live wire to remain suspended, charged with a deadly current, over a street and in such manner that it is likely to come in contact with persons on horseback or in vehicles traveling along the public street. (Eaton v. City of Weiser, 118 Am. St. Rep. 225.)

(2)

An electric light company, furnishing and maintaining an electric light in a store, and receiving monthly compensation for the service, must use reasonable care in placing it, and to that extent the company is a company in possession of the store as to all persons lawfully entering it. . . . And if such a company hang a heavy fixture to the ceiling but attach it to a flimsy board which tears loose, allowing the fixture to fall, injuring the clerk in the store, the company is liable as such a tenant. (Fish v. Waverly Elec. Light & Power Co., 82 N. E. 150.)

EIGHT-PARTY SELECTIVE SIGNALING.

By J. E. McGillivray.

A recent telephone installation of novel character is that of the Eastern Oregon Telephone Co., at Hermiston, Oregon, where as many as eight telephones are placed on one line, to signal selectively. This plant is the first one of the kind to be put in in the West. The problem of economy of operation in telephone plants hinges largely on the number of circuits operated for a given number of subscribers, and this fact has made the field for exploitation of party-line service an attractive one for operating companies.

In the early days of telephony numberless devices were brought forward to reduce the interference on party lines, but they were without exception discarded, and for a long time nothing was done to develop this feature. For the past year or two all of the leading telephone factories have been expending their effort in developing selective signaling apparatus, and the "8-party" plant at Hermiston is an illustration of the high stage which this development has reached.

At Hermiston it is possible to operate any number of telephones on a line up to eight, signaling each selectively, and sixteen telephones can be placed on one line to signal semi-selectively. The following is a brief description of the operation of this system, where the full eight telephones are used on a line. To use a less number it is only necessary to make the installation of the required number:

On the eight telephones are eight relays, four connected from tip to ground and four from sleeve to ground. Two of those connected from tip to ground operate on positive battery current, and the other two operate on negative battery current.

The same is true of the other four, which are connected from sleeve to ground, two operating with positive and two with negative battery current. These relays are so constructed that they are not affected by the passage of alternating current. It will thus be seen that the eight relays operate in four groups—two, for instance, operate when positive battery current is connected to tip, and two when negative battery current is connected to tip; two when positive battery current is connected to sleeve, and two when negative battery current is connected to sleeve. The eight-party key makes these selections.

It is apparent that when signaling any station two relays will operate, but only one bell will ring, and that is the bell of the particular telephone which it is desired to call. The reason is this: Assume, for instance, that the relays at stations one and five which are both connected from tip to ground, and which both operate when positive battery current is impressed on the tip line, are drawn up when button one of the selective key is depressed and the ringing key of the particular circuit which is used is actuated. It will be seen that the relay at station one, however, connects the bell "B" from the sleeve wire to ground and that the relay at station five connects the bell "B" in circuit, which amounts to the same thing as connecting it between tip and ground. Thus two relays operate and connect two bells onto the metallic line, one on tip and one on sleeve, thus forming a regular divided circuit arrangement.

The remaining six bells are, of course, off the line, because the remaining six relays have not been operated. It is thus that with only two bells on the line the regular exchange ringing equipment can operate these bells selectively, by having ringing current on tip to ground or ringing current on sleeve to ground, and this selection is made through an eight-party key; thus button one of the eight-party key when depressed connects positive battery current from tip to ground, but ringing current from sleeve to ground, while button five of the selective key, though it also connects positive battery current from tip to ground, however, connects ringing current also from tip to ground, thus ringing the two bells selectively. The same is true as regards the other six telephones, the relays of which are each operated in groups of two, and each bell of each group is operated the same as an ordinary divided-circuit bell. For this reason only one telephone will ring of the eight when any particular button of the eight-party key is depressed. This plant was installed by the American Electric Telephone Company, of Chicago.

Under the management of Mr. W. W. Pankey, the Eastern Oregon Telephone Company is forging rapidly to the front. The new exchange has been completed at Hermiston and a toll line between Echo and Hermiston. This company now reaches, over their own lines, Pendleton, Heppner, Pilot Rock, Echo, Hermiston, and their country lines cover the immense Government irrigation project lying between Hermiston and Umatilla. Mr. Pankey's long service with the Pacific Telephone & Telegraph Co. has given him a wide experience in telephone work and fitted him for the duties of general manager of this new and progressive company. Mr. Pankey assumed personal charge of the construction of the Hermiston exchange and toll line, and the class of construction is a testimonial to his ability.

OLD MATERIAL AND SUPPLIES.

The disposition of old material and supplies is one of the vexing problems in telephone work. The many changes in kinds of material and supplies has made the second-hand stock grow with startling rapidity. Much of this second-hand stock is serviceable, but, so to speak, is "not in style." In using this "out-of-style" stock, care must be taken that it is used in such a way that the service or plant does not suffer.

It is essential that material that is serviceable, although out of style, be kept in service. This must be done in all lines of business, from that of farming to operating a railway system. When the farmer builds a new fence, the parts of the fence displaced that have life in them will be used on some other part of the farm, possibly for repairs to another fence. The railway uses its old and obsolete engines for switching and on branch lines, and would not consider using new rails on some unimportant siding if old rails were in stock.

This is exactly the thing that must be done in a telephone plant, and the telephone manager must be competent to carry out such a policy.—"The Pacific Telephone Magazine."

TOLL LINE DON'TS.

Don't make a careless joint in a toll line and expect the toll line to give first-class service.

Don't use rubber-covered wires for toll lines when bare wires can be used.

Don't forget that "continuous service" is what makes the toll line popular with the public.

Don't allow noises to continue on your toll lines.

Don't neglect the transmitter batteries at toll stations.

Don't open or ground a working line before making sure that it is not being used.

Don't wait until to-morrow to clear trouble that should be cleared to-night.

Don't imagine that a toll wire laying on the cross-arm will not give trouble.

Don't use a No. 7-A test connector in a toll line. Nothing but No. 5-A test connector should be used.—"The Pacific Telephone Magazine."

POSSIBILITIES OF WIRELESS TELEPHONY.

In the course of a paper recently presented before the American Institute of Electrical Engineers, Mr. R. A. Fessenden states that there is no immediate prospect that wireless telephony will take the place of local exchanges. The difficulty in regard to the number of tunes can be overcome, but the fact remains that high frequency oscillations cannot be transmitted over wire, and hence each subscriber must have his own generating station. At the present time no method is known which would be practical if placed in the hands of a subscriber.

He believes, however, that there is a field for wireless telephony for long-distance lines. The present long-distance lines are very expensive to construct and to maintain, and a storm extending over any considerable section of country inflicts considerable loss on the telephone companies. Moreover, the distance of transmission is limited by the electro-static capacity of the line. Wireless telephony would have the following advantages:

1. The initial cost would be very much less than that of wire lines.
2. The maintenance would be practically negligible in comparison.
3. In case of any breakdown, it would be right in the station and not at some unknown point outside on the line.
4. The depreciation would be comparatively small.
5. The number of employees required would be smaller.
6. The transmission is better, and as there is no distortion of the speech, the working distance is, it is believed, considerably greater.
7. The flexibility is greater. With wire lines a telephone company may not be able to give a Boston subscriber a line to New York, while having lines from Boston to Chicago and from Chicago to New York free. Operating wirelessly, the wireless circuit normally used for operating between New York and Chicago and between Boston and Chicago could be used to operate from Boston to New York.
8. No right of way need be purchased, and franchises, it is believed, are not necessary.

It will be noted that he carefully avoids mentioning any of the disadvantages of wireless telephony for long-distance work. He hopes the defects will be supplied by the experts who are familiar with telephone operation and therefore better able to point them out. He says the question of interference has been worked out to such an extent that no serious difficulty need be feared in that direction.

Wireless telephony is peculiarly suited for transmarine transmission. Pupin's ingenious and beautiful method has been successful at Lake Constance, Switzerland, but even assuming that deep-sea cables of this type could be laid and operated successfully, they would nevertheless be very much more expensive than wireless telephony stations. It is believed that wireless telephony will come in extended use for this purpose. Even without further development telephonic communication could be established between Norway or Denmark or Germany or Spain and Great Britain; between Sardinia and Corsica and France and Italy; between France and Algeria; between Australia and Tasmania and New Zealand; between the United States and Cuba and Porto Rico, etc., were it not that it is at present forbidden by law.

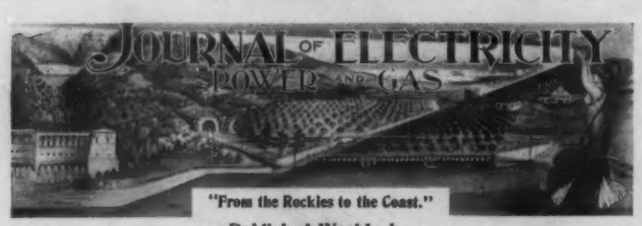
Wireless telephony from ship to ship is one of the most important applications. Wireless telegraphy has the disadvantage that a telegraph operator must be carried. The additional expense is an objection in many cases. The proposition that the captain or mate should also be a telegraph operator has not met with favor. Anybody, however, can operate the wireless telephone and almost every vessel carries an engineer capable of repairing the electrical apparatus in case of accident. Wireless telephony from ship to local exchange will have considerable value, as enabling the captain of a vessel to communicate, by relaying over the wire line, with the owner of the ship, or enabling a passenger on a vessel to communicate with friends on shore.

The great obstacle to long-distance wireless telegraphy and telephony is atmospheric absorption. For short distances up to 100 miles in the Temperate Zone there is little difference between the strength of the signals at one time of the day and another. As soon as the distance is increased much over 100 miles for the Temperate Zones and forty or fifty miles for the Tropics the signals at night are very irregular and there is great absorption during the daytime. The daylight absorption may be so great that less than a tenth of one per cent of the energy transmitted gets through. Some nights will be as bad as daytime, while on other nights there will be apparently no absorption.

It has been found that while there is great absorption for frequencies of 200,000 there is comparatively little absorption for frequencies in the neighborhood of 80,000 and messages have been successfully transmitted in daylight with this latter frequency. No messages were received in daylight with the higher frequency, though messages transmitted from the same station and with the same power and frequency were officially reported as having been received at Alexandria, Egypt, a distance of approximately 4000 miles. The fact that these experiments were made during summer weather, and the receiving station was in the Tropics, and the fact that the distance, 1700 miles, was practically the same as that between Ireland and Newfoundland, definitely settled the question as to whether long-distance wireless telegraphy was a commercial possibility or not. Since the publication of the above results transmission has been accomplished by means of these long waves over still greater distances during daylight. Sig. Marconi early in October, 1907, succeeded in operating between Glace Bay, Nova Scotia, and Clifden, Ireland, a distance of more than 2000 miles, at a frequency of approximately 70,000. The same messages were received at Brant Rock, Mass., a distance of nearly 3000 miles. Still more recently, Captain Hogg of the "Glacier" has written that during the southward passage of the Pacific fleet he received messages from the station at Brant Rock, Mass., while off Cape Ste. Roque, Brazil, S. A. The frequency used for sending was approximately 80,000, and the messages were received with the very interesting and sensitive silicon receiver invented by Mr. Pickard. This distance of 3000 miles is the greatest yet achieved by wireless transmission during daylight and would indicate that with the use of suitably high towers much longer distances can be reached.

For the same power it is possible to telegraph to a further distance than to telephone. Distinct speech depends upon the presence of harmonics of a frequency as high as 1200 per second. The amplitude of these harmonics is, according to some rough experiments made by the writer, only about one per cent of the fundamental frequency. Consequently, with a perfectly modulated transmitter 100 times as much energy would be necessary to telephone a given distance as to telegraph. It fortunately happens, however, that a carbon transmitter and also the circuits in which it is used can be so constructed as not to modulate perfectly, but can be arranged so as to accent the higher harmonics.

With transmitters arranged for the purpose good transmission has been obtained with thirty times the energy required to produce audible telegraphic signals. By still further modification the power required has been reduced to approximately ten times that necessary for telegraphing, curiously enough without noticeably distorting the character of the speech. There is one fact, however, which prevents the ratio from being as large practically as the instruments show, i. e., speech can be satisfactorily understood with a less increase of power above a minimum audibility than telegraphic signals.



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EDITORIAL.

POSSIBILITIES AND PROBABILITIES.

In the wave motion of human achievement, possibility is seldom in phase with probability. The latter lags, time being the necessary factor of conversion. So, while we marvel at the statements made elsewhere in our issue by Mr. R. A. Fessenden as to the possibilities of the wireless telephone, yet there is little doubt but what they will become not only probabilities, but actualities, within the next decade. The most promising field for the wireless telephone is on shipboard. Telephoning through submarine cable has presented great difficulties, as indicated in the article we print on "pupinized" cable. While this has given a partial solution to the problem, wireless telephony promises to completely clear it.

With the entrance of means for producing continuous undamped signals, it became possible to transmit speech by superimposing its variations upon the wireless wave. The distance of transmission on the wireless telephone is much less than that of the telegraph, atmospheric absorption interfering greatly with ranges over one hundred miles. But improved methods and more powerful apparatus are expected to extend these space limits.

Another subject of great possibilities is that of the automatic telephone as compared with the manual system. In an exhaustive paper read at the semi-annual meeting of the American Institute of Electrical Engineers, Mr. W. Lee Campbell makes some graphic comparisons as to first cost and operating expenses. With the manual he finds the cost per line increases rapidly with the size of the office, whilst with the automatic the increase is relatively slow. The automatic equipment occupies half the space and costs the same, when the exchanges are sub-divided. The author comments on the slow service and greater liability of mistakes with the manual and shows the facility with which the automatic can be expanded. The chief disadvantage to be urged against the system is the heavy trunks required. Two-way trunks, available both in calling and in answering, may possibly remove these difficulties. The probabilities in this case are that multi-office switchboards will eventually displace party-line service without increased rental.

The task of making these possibilities actualities is an inviting one. As their details become more familiar their practical significance will become patent. Meanwhile the layman is to be warned of the danger of placing too much credence in the claims of certain widely advertised wireless telephone companies. "Fools rush in where angels fear to tread."

CROSS-TALK.

DUCK UPSETS TELEPHONE LINE.

A spoonbill duck was the cause of the suspension of the long-distance telephone service east of Watertown, S. D., a little while ago. All tests known to the management of the system were applied, but failed to locate the seat of trouble. A lineman was then dispatched by team and found that a spoonbill duck, in its flight from one lake to another, had evidently started to quack either a greeting or a warning to its mate and had caught the wire full in the mouth, the momentum carrying it against a second wire, the two forming a vise-like grip upon the bird's neck, the body making several revolutions around the wires and twisting them into a cable, thus short-circuiting the system. The duck, with a broken neck, was still hanging from the wires when the lineman reached the scene.—Sound Waves.

TEN TELEPHONE COMMANDMENTS.

1. Thou shalt call by number only.
2. Thou shalt always answer thy telephone at the first sound of the bell.
3. Thou shalt not use thy telephone when the lightning cracks in the sky, for verily I say thou endangerest thyself and will not be answered.
4. When the operator says, "Shake up your transmitter," thou shalt shake, even if it givest thee paralysis.
5. Thou shalt not call again directly after ringing off, else the operator deem it a ring-off and not answer.
6. Thou shalt not expect to get a party in another town directly after calling, for the line may be busy or the party not to be found.
7. Always shalt thou ring off when through speaking, for it will save confusion all around.
8. Thou shalt not rave and cuss at the operator if he does not answer on the dot, for he is busy and will attend to thy wants as soon as possible.
9. Never shalt thou flirt with the operator nor force her to converse with thee for it doth impair the service.
10. Above all never shalt thou get huffy and lose thy temper but be thou courteous and pleasant voiced, and remember especially that thine is not the only wire in the cable.—Telephony.

PERSONAL.

Fred B. Jones is now General Superintendent of the Utah Independent Telephone Company at Salt Lake City, Utah.

Chas. A. Rolfe, of the Southwestern Home Telephone Company at Redlands, Cal., has been in San Francisco this week.

John N. Wallace has been appointed chief engineer for the Vote-Berger Company of La Crosse, Wis., succeeding C. D. Enocks.

J. E. McGillivray, of the American Electric Telephone Company of Chicago, has been at Phoenix, Ariz., where his company is placing equipment for the newly organized Independent Telephone Company. From there he will go to Miles City, Montana.

W. L. Holland has succeeded J. M. Kean as manager of the Long Beach, California, exchange, Mr. Kean having been transferred to the management of the Santa Maria exchange of the Pacific Telephone & Telegraph Co. This had been made vacant by the resignation of L. F. Larson on account of ill health.

W. W. Dean has been elected president of the Dean Electric Company of Elyria, O. He succeeds Mr. Samuel B. Rawson, recently deceased, who was one of the best known independent telephone men in the East, having been responsible for the greater part of the independent telephone development in the greater part of Ohio and New York.

TRADE CATALOGUES.

The Scott Electrical Co., 58 Nassau Street, Newark, N. J., picture their arc lamps in a neat booklet.

The Standard Electric Works of San Francisco have ready for distribution Couch & Seeley Catalogue 8A on standard telephones.

"Brownhoist" machinery, as adapted to the use of artificial gas, coke and electric light companies, is the subject of a handsome bulletin from the Brown Hoisting Machinery Co., of Cleveland, Ohio.

The H. W. Johns-Manville Co. show the uses of their Anti-Sweat Pipe Covering, in a recent leaflet. Ferro Cement, a chemical iron compound for smoothing and filling blow-holes in castings, is described in No. 8317.

The Whiting Foundry Equipment Co., of Harvey, Illinois, have issued a second edition of their "Foundrymen's Reference Book" for general circulation. It contains several new suggestions for reducing operating costs.

Chicago Fuse Wire & Mfg. Co., 170 So. Clinton St., Chicago, Ill., send a leaflet illustrating and describing "Union" Sectional Switch Boxes, which take all makes of switches and receptacles, and can also be built up into any number of gangs.

H. Krantz Mfg. Co., 160 Seventh Street, Brooklyn, N. Y., sends several interesting leaflets illustrating several installations, including the Metropolitan Life Insurance Building, New York; the St. Regis Hotel, and John Wanamaker's store. Water-tight floor boxes are also illustrated and described.

Holtzer-Cabot Electric Co., Brookline Station, Boston, Mass., have issued Bulletin No. 307B, listing and describing Buffing and Grinding Motors for Direct and Alternating Current. No. 314A treats of Type "C" Direct-current Motors and Dynamos, open and semi-enclosed type. Type "L M" Motors for direct current are illustrated and described in Bulletin No. 316 as being designed to meet the demand for a direct-current motor interchangeable with an alternating-current motor of corresponding size.

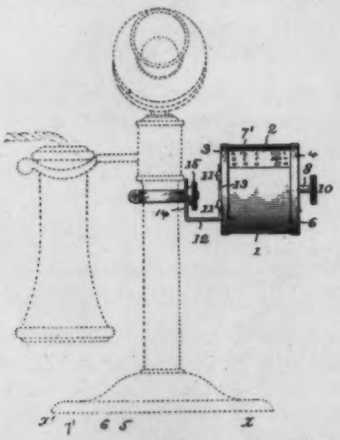
Westinghouse Electric & Mfg. Co., of Pittsburg, Pa., detail by text and picture in Circular No. 1101, the various improvements that they claim make the Westinghouse No. 93-A2 Railway Motor, the most successful for direct-current service. They have a continuous load capacity of fifty amperes at 300 volts, and are built to withstand hard work. No. 1152 is devoted to Westinghouse Type H F Polyphase Induction Motor, which is particularly designed to maintain low starting current and severe conditions. Westinghouse Type A Single-phase Motors are illustrated and described in No. 1153. They are especially adapted for operating from a remote point, or for operation that is entirely automatic.

Devices for the automatic control of induction motors are described in Bulletin No. 4590, just issued by the General Electric Company, Schenectady, N. Y. The automatic compensators described in this bulletin are designed for the remote or automatic operation of the General Electric Form K induction motors, or other motors of the squirrel cage type in sizes of 5 H. P. and larger. They consist of two main oil immersed switches operated by solenoids, which are excited from one phase of the current supply. The same publication describes an automatic control equipment for use in connection with the General Electric Form M three-phase induction motors, the principal use of which is in maintaining a pre-determined air pressure, water pressure or water level, by automatically starting and stopping motor driven pumps in the supply mains.

PATENTS

TELEPHONE-DIRECTORY. 890,908. William R. Hunter, Kankakee, Ill.

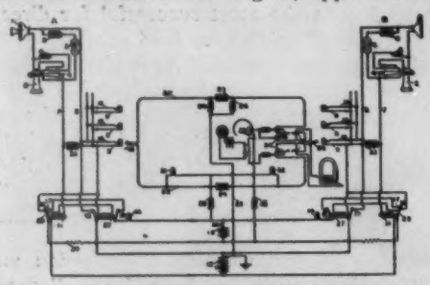
A directory attachment for telephones comprising an inclosing housing having a view gap in its side and a plurality of loops at one end, a cylindrical directory journaled



in said housing, means for rotating said cylinder, and means for connecting the housing to a telephone, the same comprising a stirrup-shape clip, the vertical members of which are forked for engagement respectively with an attaching screw on the telephone and with the loops on the housing.

TELEPHONE SYSTEM. 888,870. Elmer R. Corwin, Clyde, Ill., assignor to Monarch Telephone Manufacturing Company, Chicago, Ill.

In a multiple switchboard system, the combination with metallic telephone lines, each terminating at the exchange in a plurality of jacks or connecting switches, a double talking conductor cord circuit for connection with the jacks, a disconnect signal, a circuit therefor local to the exchange, including a portion of a talking conductor of the cord circuit, registering contacts of a jack or switch and the plug or switch of the cord circuit engaging said jack, a line signal-effecting relay in association with the telephone line acting in combination with the said plug and jack to govern the operation of the disconnect signal, apparatus at the sta-



tions of the telephone lines governing the operation of the line relays, a cut-off relay for effacing the line signal included in the same circuit with the disconnect signal, said line relay effecting the operation of said line signal when a call is initiated over said telephone line, one battery or source of current for supplying the line relays of said telephone lines and the transmitters at the subscribers' stations of said lines, another battery distinct from the aforesaid battery adapted to be included in the disconnect signal circuit, a test circuit including said latter battery, a sleeve contact of an inserted plug, the thimble of the jack receiving said plug, the test contact of the connecting plug, the disconnect signal, and a testing device in circuit with said test contact.

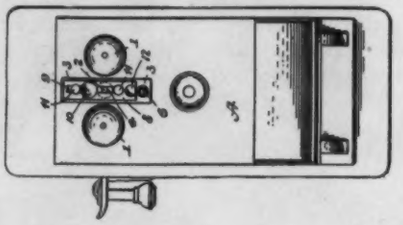
TELEPHONY. 888,507. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa.

In telephony, means to neutralize earth currents in a line of transmission, said means comprising an inductorium,

one coil connected to the line of transmission, the second coil connected to the ground; one of said coils constructed so that one part has an inducing effect opposite to the inducing effect of the second part.

TELEPHONE CUT-OFF OR MUFFLER. 888,822. George S. Knowles, Buffalo, Mo.

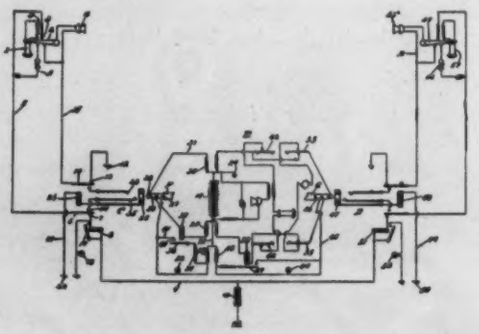
A telephone cut-off or muffler comprising a plate adapted to be secured to a telephone box and in communication with the batteries, said plate having an opening



therein for the bell clapper and a slide having an elongated slot for receiving the bell clapper, whereby it is prevented from striking the bell, and when the slide is moved from its normal position cutting out the batteries.

TELEPHONE SYSTEM. 889,582. Henry P. Clausen, Chicago, Ill., assignor to American Electric Telephone Company, Chicago, Ill.

The combination with a telephone line and a connection terminal therefor normally not in operative relation with the line, of a connecting plug and cord circuit to co-operate with said line, a supervisory signal controlling magnet and a battery associated with said cord-circuit, a telephone transmitter and a switch at the subscriber's station, and means controlled over a strand of said cord circuit by the insertion



of the plug into the jack for placing the jack in operative relation with the line, whereby talking current is furnished to said transmitter and said magnet is placed under the control of the subscriber, a ringing circuit including both sides of the subscriber's line in series, said supervisory signal means comprising an armature, an energizing circuit for causing the attraction of said armature, said energizing circuit including both sides of the telephone line, and a line signal adapted to be retired if the calling subscriber hangs up his receiver before the operator answers the call.

INDUSTRIAL

THE DEAN "UNBREAKABLE" DESK STAND.

Nearly every telephone operating company charges a higher rate for service when desk set instruments are furnished. Such an increase in rental has been justified by the larger maintenance expenses. The average telephone user expects to pay more for a desk set than he does for a wall set, because, for one thing it is often so much more convenient, and then he realizes that the liability of breakage increases the amount of repairs required. He willingly pays more.

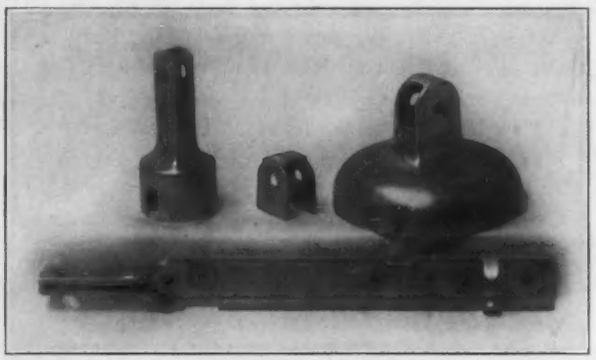


FIG. 1.—PARTS DRAWN FROM COLD SHEET STEEL, USED IN DEAN "UNBREAKABLE" DESK STAND.

Now, with the telephone-using public educated to pay more for such service, if it were possible to reduce the maintenance of desk sets to a figure as low as similar charges for wall types and continue to get the higher rate for the former, the result would be a material increase in earnings. The desk-set business would be a good money maker.

This opportunity is now offered, so the manufacturers claim, by the use of the improved desk set now being sold by the Dean Electric Company. The only source of trouble with the type formerly manufactured by this company was the breakage of cast parts. In the new style, all castings have been eliminated by the substitution of parts drawn from cold sheet metal. All of these new parts are shown in

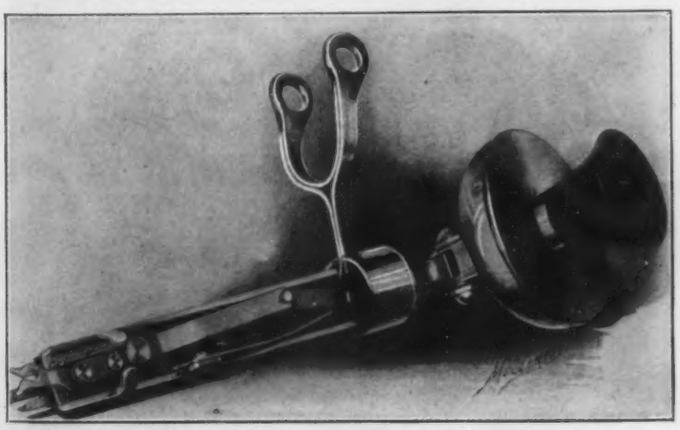


FIG. 2.—ASSEMBLY OF PARTS OF DEAN DESK STAND WITH TRANSMITTER AND SWITCHHOOK MECHANISM.

Fig. 1, while Fig. 2 shows them assembled with the transmitter and switch-hook mechanism. This assembled part is automatically inserted in place in the framework and base, as in Fig. 3.

The framework is composed entirely of steel. The large center stem extends from the base to the transmitter mounting shell—the latter is bolted directly to the piece. The exposed nickel-plated parts are drawn from brass, since it has been conclusively demonstrated that this metal takes a more durable plating and provides for surface that is absolutely rust-proof.

The new set is designed to be absolutely unbreakable, even with abusive use. Of course, transmitter mouthpieces and receiver shells are broken on rare occasions, but these parts also give the same amount of trouble with wall sets. The point made by the manufacturers is that the improved Dean desk set costs no more to maintain than the best wall instruments.

FIG. 3.—DEAN "UNBREAKABLE" DESK STAND, COMPLETELY ASSEMBLED.

The Dean company supplies a composition transmitter mouthpiece and receiver shell that is sold at about half the cost of the hard-rubber article. It is claimed that this composition is more durable than, and equal in appearance to, hard rubber.

THE CUTLER-HAMMER MFG. CO. TO BE REPRESENTED IN SAN FRANCISCO.

An announcement printed elsewhere in this issue will be read with interest by all users of electric controlling devices on the Pacific Coast. The Cutler-Hammer Mfg. Co., of Milwaukee, the largest makers of electric controlling devices in the world, has just completed arrangements whereby they will be represented on the Pacific Coast by Otis & Squires, of 111 New Montgomery Street, San Francisco. A large stock of standard Cutler-Hammer controllers will be carried by Otis & Squires, enabling them to make prompt delivery of apparatus. Mr. A. W. Vinson, who has for several years been connected with the engineering department of The Cutler-Hammer Mfg. Co., has been transferred to the office of Otis & Squires, where he will be glad to aid in the solution of any problems involving electric control. This arrangement should prove of great benefit to those confronted with problems of control which cannot be met by the use of standard apparatus.

NEWS NOTES

TELEPHONE.

California.

Covina, Cal.—The Home Telephone Company has installed a complete new equipment in their Azusa exchange.

Orland, Cal.—The Glenn County Telephone Company are installing a common battery switchboard in their Orland exchange.

Palo Alto, Cal.—A No. 8 common battery switchboard has been installed at Palo Alto by the Pac. T. & T. Co. The cut-over was done with no trouble.

San Bernardino, Cal.—When the new exchange of the Pac. T. & T. Co. is completed, all aerial wires will be removed and underground cable pulled in through the downtown district.

Santa Margarita, San Luis Obispo Co., Cal.—The government telephone line has been completed from Santa Margarita to Frees Camp, giving additional fire protection to the forest reserve.

San Francisco, Cal.—The new public telephone office at the Ferry Building contains ten booths, enclosed in a well-lighted room handsomely furnished in mahogany. The booths have double walls with air space between, with electric light automatically lighted as the door is closed.

Los Angeles, Cal.—The Home Telephone & Telegraph Company of Los Angeles recently invited its patrons to inspect their exchanges at 716-722 South Olive Street and 246 South Hill Street. At South Olive Street was shown the new automatic apparatus, and at South Hill Street the old style or manual switchboard, the comparison between the old and the new method being interesting. Expert telephone people were in attendance to explain both systems.

Napa, Cal.—The Clear Lake Telephone & Telegraph Company, a new competing line, has been organized to construct and operate new telephone lines in Napa, Sonoma, Mendocino and Lake Counties, principally between the following points: From Lakeport to Calistoga, from Lakeport to Cloverdale via Highland Springs and Pieta, from Lakeport to Kelseyville and from Pieta to Hopland. The company has a capital stock of $50,000, and the Board of Directors consists of A. H. Spurr of Lakeport, H. S. Johnson and F. L. Wright of Santa Rosa. L. J. Shuman and M. S. Sayre of Lake County are also largely interested in the new company.

Chico, Cal.—The Pacific T. & T. Co. has resumed work on the reconstruction of its Chico system, and over twenty linemen are engaged in extending the facilities for handling an increased number of subscribers. F. W. Bennett, special agent for the company, is in Chico from the Sacramento office to make a canvass for new subscribers in the eastern section of the city and in South Chico. Mr. Bennett states the company is trying to do away with the four-party lines as rapidly as possible and to install main and two-party lines. In the residence section a charge of $2.50 per month will be made for main lines and $2 for a two-party line. No quoting is made for four-party lines. In the business section $4 is charged for main lines and $3 for two-party lines.

Idaho.

Wallace, Idaho.—The North Idaho Telephone Company have completed arrangements to put in a complete new equipment in Wallace.

Boise, Idaho.—Under the efficient direction of Messrs. Beggs and Sinsel, respectively president and general manager, the Independent Long Distance Telephone Company of Boise are rapidly enlarging and improving their system. The Boise plant with the long-distance lines and country exchanges now represent an investment of half a million dollars, and this is to be increased very materially in the next year. New installations are to be made at Weiser, Ontario and Nampa, and the long-distance service considerably extended.

Montana.

Anaconda, Montana.—The Montana Independent Telephone Company are installing complete new equipment at Anaconda.

Oregon.

Marshfield, Ore.—The City Council has granted to R. L. Durett a franchise for operating a new telephone line in this city. Durett states that the Home Telephone Company of Portland is behind him.

Florence, Ore.—The Coast Line Telephone Company of Florence filed articles. The incorporators are D. M. Kemp, C. H. Holden and C. E. Harwood, and the capital stock is $2,500. The object is to build and maintain a telephone line in the vicinity of Florence.

Portland, Oregon.—At the automobile road race in Portland on June 4th the Pacific Telephone Company strung a loop around the 14-mile course, installing seven telephones upon it. As the machines passed, they were reported to the management at the grand stand and bulletined on a large blackboard before the spectators.

Utah.

Cedar City, Iron County, Utah.—The switchboard and telephones have arrived for the installation of the exchange. Most of the outside construction work is completed and it is expected that the plant will be ready for operation by August 1st. The four-party bias spring equipment is to be used. Cedar City is the nucleus for an extensive plant that it is intended will cover a large section of Southern Utah. The American Electric Telephone Company are furnishing the apparatus. Mr. Chas. S. Wilkinson of Cedar City is the active head of the concern.

Washington.

Puyallup, Wash.—Construction of the Pake Telephone Company's proposed system in Puyallup will be begun soon.

Bellingham, Wash.—The Pac. T. & T. Co. has changed 2300 instruments from local battery to central energy system at Bellingham.

Ellensburg, Wash.—The Northeast Telephone Company has petitioned the county commissioners to permit the erection of a telephone line along certain county roads in Kittitas County.

Friday Harbor, Wash.—Work on the United Wireless Telegraph Company's station on Bald Hill is well under way. Besides an operating building, the company will erect a dwelling for the operators and service will be maintained day and night.

Chelan, Wash.—The new rural lines have been placed in service and great satisfaction is expressed by the users at the convenience afforded. The East Side Company and the Howard Flat Company are the two organizations which have promoted this enterprise.

Tacoma, Wash.—Arrangements are being made for the construction of a telephone line from Ashford, in the Succotash Valley, to Longmire Springs, on the west slope of Mount Rainier. The matter will be taken up at the annual meeting of the Paradise Valley Club.

Spokane, Wash.—A new telephone exchange, to be known as "Maxwell," was cut-over on May 29th. The new exchange is provided with standard equipment, the switchboard being equipped for 2100 lines with 3800 stations, and having an ultimate capacity of 4500 lines and 9600 stations.

TRANSPORTATION.

San Francisco.—The Southern Pacific Company has begun work on electricizing its Alameda local lines.

Biggs, Cal.—Word has reached here that the citizens of Gridley have about completed arrangements whereby the Northern Electric will build a spur track into that city.

San Francisco, Cal.—The United Railroads has applied for permission to build a power house at the corner of Beach and Buchanan Streets. The estimated cost of the building is $63,000.

Marysville, Cal.—W. P. Hammon, president of the Yuba Consolidated Gold Fields Company, while on a visit to this city, took occasion to deny the report that he is to succeed Henry Butters as president of the Northern Electric Co.

Santa Monica, Cal.—A project for the building of a local street railroad system independent of the Los Angeles-Pacific has been started. Promoters say they intend to raise $100,000 by selling stock on the installment plan to residents.

San Diego, Cal.—Announcement is made to the effect that actual construction will be started next week by the South San Diego Investment Company on a street railway which will connect the present terminus of the Coronado belt line in South San Diego with the Imperial branch.

Santa Monica, Cal.—Santa Monica is to have improved electric communications with Los Angeles, equal to the car service Venice is enjoying, when the Southern Pacific branch has been electricized. General Manager R. S. Sherman of the Los Angeles-Pacific Company says flyers will be run over the branch as soon as the line is in operation.

Chico, Cal.—It is announced that the general manager's office of the Northern Electric will be moved from Chico to the company's new office in the Alaska Commercial Co.'s building, California and Sansome Streets, San Francisco. This is to bring General Manager A. D. Schindler and his secretary, W. J. Hanford, into closer touch with headquarters, which will be in the above-named building. Assistant General Manager Melville Dozier will still be stationed in the local office.

TRANSMISSION.

Reno, Nev.—Col. W. C. Rose of Tonopah, who arrived here last week, says he has plans to use the water of Humboldt County for the development of electricity to furnish power to the Seven Troughs mining district camps.

Redding, Cal.—George D. Barber, principal owner of the Happy Valley Land & Water Company, has filed in the county recorder's office notice of water appropriation which indicates that he is engaged in promoting a new scheme.

Redding, Cal.—H. A. Tedford, acting in behalf of the Northern California Power Company, has filed two notices of water appropriations, one for 3000 inches of the waters of Bailey Creek and the other for 5000 inches of the water of North Battle Creek.

Oroville, Cal.—According to engineers of the Great Western Power Company, the plant will be able to supply power about October 1st, as nearly all the transmission poles are in place. The Western Pacific also has hauled considerable structural steel to the power company's plant three miles this side of Berry Creek.

Redding, Cal.—L. Shannon has filed a notice for the appropriation of 5000 inches of the water of Bear Creek in this county, to be used for the generation of electrical energy and for irrigation and domestic purposes. Mr. Shannon was the original promoter of what is now the Northern California Power Company and also of the Shasta Power Company. He is now engaged in developing a power proposition on Bear Creek, fifteen miles east of Redding, to be known as the Shannon Power Company.

ILLUMINATION.

Tempe, Ariz.—Harry Chandler of Mesa is here and proposes to take the matter up with the Tempe Board of Trade and get that body's views on the proposed new gas plant from Tempe and Mesa.

San Francisco.—The Board of Harbor Commissioners has asked for specifications for installing an electric lighting plant on tug boats as follows: Governor Markham, $1460; Governor Irwin, $1460, and State Dredger No. 3, $136.

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Good Treatment
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TELEPHONE KEARNY 2591
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FORMERLY
CENTURY KLEIN ELECTRIC CO.
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Largest in the world devoted exclusively to the manufacture of Electric Controlling Devices.

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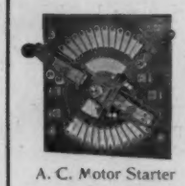
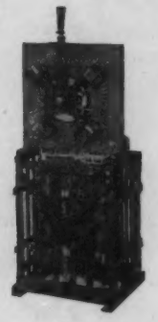
A complete line of standard Cutler-Hammer controlling devices will be carried in stock at the above address and one of our own engineers has been assigned to this office to aid in the solution of special problems involving the control of electric motors.

THE CUTLER-HAMMER MFG. CO.

MILWAUKEE WISCONSIN



A. C. Motor Starter



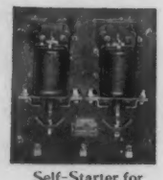
Crane Controller

Self-starter for A. C. Motor

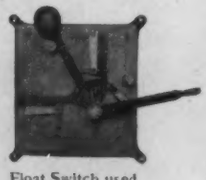
Machine Tool Controller

Printing-press Controller

Gauge Type Pressure Regulator used with self-start r

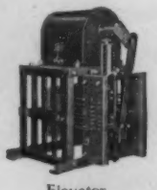


Self-Starter for D. C. motor

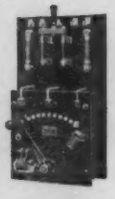


Float Switch used with self starter

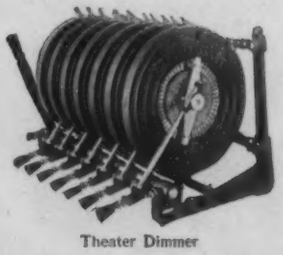
Dynamo Field Regulator



Elevator Controller



D. C. Motor Starter



Theater Dimmer